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BULKY SHEET AND MANUFACTURING METHOD THEREOF

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[Amendments have been incorporated into the text of this translation.]

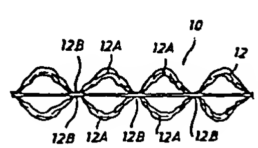
Abstract

Objective

The objective of the present invention is to produce a bulky sheet having a specific strength as well as excellent softness and agreeable to the touch, and a manufacturing method thereof.

Constitution

In the bulky sheet of the present invention, a nonwoven fabric-like fiber aggregate 12 formed as a result of entanglement of fibers is integrated with one surface or both surfaces of mesh sheet 11 also in an entangled state, and at the same time, many peaks and valleys greater than those of the mesh sheet are formed on the surface of the above-mentioned fiber aggregate 12.



Claims

1. A bulky sheet characterized by the fact that a nonwoven fabric-like fiber aggregate formed as a result of entanglement of fibers is integrated with one surface or both surfaces of a mesh sheet also in an entangled state, and at the same time, many peaks and valleys greater than those of the mesh sheet are formed on the surface of the above-mentioned fiber aggregate.

2. The bulky sheet described in Claim 1 wherein the above-mentioned mesh sheet is a net made of a heat-shrinkable thermoplastic resin produced by drawing, or a heat-shrinkable net produced by weaving or knitting a filament made by drawing a thermoplastic resin.

3. The bulky sheet described in Claim 1 wherein the above-mentioned mesh sheet is a fiber aggregate made of a heat-shrinkable fiber, latent-crimping fiber, or a mixture of the two.

4. The bulky sheet described in Claim 1 wherein the above-mentioned mesh sheet is a heat-shrinkable porous film.

5. The bulky sheet described in Claim 1 used as a cleaning sheet.

6. A method of manufacturing the bulky sheet characterized by the fact that a fiber web is laminated on one surface or both surfaces of a heat-shrinkable mesh sheet, entanglement of the structural fibers of the above-mentioned fiber web and mesh sheet or structural fibers of the above-mentioned fiber web is carried out so that the above-mentioned fiber web forms a nonwoven fabric-like fiber aggregate integrated with the mesh sheet, a heat-treatment is carried out, and heat-shrinkage of the above-mentioned mesh sheet is achieved so that a pattern is formed on the entire nonwoven fabric-like fiber aggregate.

Detailed explanation of the invention

[0001]

Industrial application field

The present invention pertains to a bulky sheet with a surface having a pattern, in particular, a bulky sheet used as a cleaning sheet for commercial and home use, a wiping material, a surface material for sanitary products, and cushioning materials, and a manufacturing method thereof.

[0002]

Prior art

For cleaning sheets, wet or dry cleaning cloths made of a woven cloth or nonwoven fabric, simple sheet-like wiping cloths such as chemical wipes, or bundles of yarn-like material such as mops, etc. can be mentioned and these are widely used in homes, offices, stores, buildings, factories, etc.

[0003]

For cleaning sheets, in order to pick up and retain a large amount of dust, a sheet having high freedom of the fiber and sufficient strength is required. In general, the degree of freedom is higher in nonwoven fabrics formed as a result of entanglement of fibers than a nonwoven fabric produced by fusion or bonding of fibers, and entrapment of dust by the fibers is significantly increased. Thus, the degree of entanglement of the fiber has a significant effect on the retention of dust. In other words, the degree of freedom of the fiber is reduced when the degree of entanglement is too high and retention of dust is not sufficient; on the other hand, when the degree of entanglement is insufficient, the strength of the nonwoven fabric is sharply reduced, and processability is inferior; furthermore, shedding of fibers is likely to occur.

[0004]

Meanwhile, a technique whereby a pattern is formed in the sheet by sandwiching a paper or nonwoven fabric between emboss rolls is known, but when the above-mentioned conventional bulky sheet is used, long-term retention of the pattern in the presence of water is not possible, and retention of the pattern is difficult when tensile stress is applied.

[0005]

As an example without the above-mentioned problems, a method where stitching (sewing) of a nonwoven fabric is done with an elastic yarn to form gathers and to impart a pattern as described in Japanese Kokai Patent Application No. Sho 64[1989]-61546. However, in the above-mentioned prior art, the gathers are forcibly formed with an elastic yarn, and bulkiness is not imparted to the nonwoven fabric that comprises the sheet itself; thus, flexibility is not sufficient.

[0006]

Furthermore, a technique where partial fusion is carried out for a non-heat-shrinkable fiber and latent-crimping fiber that comprises the nonwoven fabric and heat-treatment is carried out to form a pattern so as to produce a bulky sheet is disclosed in Japanese Kokai Patent Application No. Sho 61[1986]-215754 and Japanese Kokai Patent Application No. Hei 2[1990]-160962. In this case, a bulky pattern can be formed in the portion of the nonwoven fabric structure consisting of a non-heat-shrinkable fiber of the sheet produced by the above-mentioned method, but the pattern formed is limited to a relatively small pattern, or the layer structure comprising the latent-crimping fiber forms a high density state; thus, the layer comprising the latent-crimping fiber becomes stiff and the flexibility of the sheet itself is sharply reduced.

[0007]

Problems to be solved by the invention

Furthermore, the size of the pattern formed is limited in the above-mentioned methods of the prior art, and a high proportion of fibers are bonded to the layer made of the latent-crimping fiber that forms the pattern, and as a result, the degree of freedom of the structural fiber is lost, and flexibility and texture achieved through the bulky portion is reduced, at times, since the area with high fiber density continuously exists. Furthermore, even when a pattern is imparted to the sheet, the nonwoven fabric that comprises the sheet itself fails to form a bulky structure, in some cases. Furthermore, in general, a bulky nonwoven fabric has a lower degree of entanglement of the structural fibers and the strength of the nonwoven fabric is sharply reduced.

[0008]

Based on the above background, the objective of the present invention is to produce a bulky sheet having specific strength as well as excellent softness and agreeable to the touch, and a manufacturing method thereof.

[0009]

Means to solve the problems

In the present invention, the above-mentioned objective was achieved by a bulky sheet characterized by the fact that a nonwoven fabric-like fiber aggregate formed as a result of entanglement of fibers is integrated with one or both surfaces of a mesh sheet also in an entangled state, and at the same time, many peaks and valleys greater than those of the mesh sheet are formed on the surface of the above-mentioned fiber aggregate.

[0010]

Furthermore, in the present invention, the above-mentioned purpose is achieved by a manufacturing method for the bulky sheet characterized by the fact that a fiber web is laminated on one surface or both surfaces of a heat-shrinkable mesh sheet, entanglement of the structural fiber of the above-mentioned fiber web and mesh sheet or structural fibers of the above-mentioned fiber web is carried out so that the above-mentioned fiber web forms a nonwoven fabric-like fiber aggregate integrated with the mesh sheet, a heat-treatment is carried out and heat-shrinkage of the above-mentioned mesh sheet is achieved so that a pattern is formed on the entire nonwoven fabric-like fiber aggregate.

[0011]

In the present invention, the mesh sheet undergoes shrinkage but actual pattern formation does not take place, and the fiber aggregate does not undergo actual shrinkage and is integrated with the mesh sheet; thus, a high proportion of patterned area greater than that of the mesh sheet is formed. Furthermore, the fiber aggregate in the present invention means entangled structural fibers and fiber web means fibers before entanglement.

[0012]

Operation

The heat-shrinkable mesh sheet undergoes shrinkage after the fibers in the fiber web are entangled; thus, the fibers comprising the nonwoven fabric-like fiber aggregate form many wave-like patterns forming many peak and valley regions, and a soft, bulky sheet having good texture can be produced.

[0013]

Furthermore, despite the relatively gentle entanglement of the fibers that comprise the nonwoven fabric-like fiber aggregate, an adequate tensile strength of the sheet can be achieved based on the mesh sheet in the bulky sheet of the present invention; thus, the sheet can be used in a wide range of applications.

[0014]

Application examples

As shown in Figures 1-4 and 6-8, nonwoven fabric-like fiber aggregate 12 is formed on one or both sides of the above-mentioned mesh sheet 11, 13, and 14 as a result of entanglement of the structural fibers as well as an entangled and integrated state with the above-mentioned mesh sheet 11, 13, and 14, and furthermore, many wave-shaped patterns 12A and 12B are formed on the surface of fiber aggregate 12 in bulky sheet 10 of the present application.

[0015]

The concept of mesh sheet is wide and includes porous films having many pores, and net 11 shown in Figure 6, latent-crimping fiber web 13 having pores shown in Figure 7, and porous film 14 having many pores shown in Figure 8. The heat-shrinkable net 11 used as the above-mentioned mesh sheet has an overall lattice pattern as shown in Figure 6, but the shape of the pores formed in the mesh sheet 11 (13 and 14) is not especially limited; for example, in the porous film 14 shown in Figure 8, the pores can be circular as shown in (b), star-shaped as shown in (a), or a combination of circular and star-shaped as shown in (c).

[0016]

As shown in Figures 3 and 4, in the above-mentioned fiber aggregate 12, the non-bonded portion surrounding the lattice of net 11 forms peaks 12A and the portion bonded with lattice 13 forms valleys 12B. The above-mentioned fiber aggregate 12 has a peak-and-valley surface made of cushions, with numberous peaks 12A and, between them, valleys 12B. Furthermore, when a film with pores, or when a net made of a fiber with a large diameter or small pores, is used, fiber aggregates on the front and back surface produce a high degree of entanglement via the pores and a film-like or lattice-like fiber is less likely to form entanglement with the porous film or net, thus, unlike the above-mentioned case, the pattern formed is based on the film-like or lattice-like fiber.

[0017]

The surface of the fiber aggregate 12 is a structure comprising entangled fibers, and in particular, when used as a cleaning sheet, fine dust on the surface of the object being cleaned is trapped by the above-mentioned structural fibers. It is desirable when a heat-shrinkable material is used as net 11 of the mesh sheet, and for the heat-shrinkable net 11, uniaxial or biaxial shrinkage is carried out for a net structure made of a thermoplastic polymer such as polyolefin, polyethylene, polypropylene, polybutene, etc., a polyester, such as polyethylene terephthalate, polybutylene terephthalate, etc., a polyamide such as nylon 6, nylon 66, etc., an acrylonitrile, vinyl, or vinylidene, such as polyvinyl chloride, polyvinylidene chloride, etc. and modification products, alloys, and mixtures thereof to form a wave-shaped pattern, or a net produced by weaving or knitting a heat-shrinkable filament selected from the group consisting of the above-mentioned polymers as a warp or weft can be mentioned, and the material is selected according to the pattern required.

[0018]

As shown by the mesh sheets in Figure 8, when a film 14 having pores is used, a film made of the above-mentioned polymers capable of undergoing shrinkage in a uniaxial or biaxial direction with pores formed by punching, etc. can be used. Furthermore, as a mesh sheet, mesh-like web 13 having pores such as the one shown in Figure 7 can be used as well, and for the above-mentioned mesh-like web, heat-shrinkable fibers made of monoolefin polymers such as ethylene, propylene, and butene and copolymers thereof, ester polymers and copolymers such as high-density polyethylene, low-density polyethylene, linear low-density polyethylene, polypropylene, ethylene-polypropylene copolymer, ethylene-vinyl acetate copolymer, polyethylene terephthalate, and polybutylene terephthalate, vinyls and vinylidene polymers and

copolymers such as polyvinyl chloride and polyvinylidene chloride, polyamide polymers and copolymers such as nylon 6 and nylon 66, acrylonitrile polymers and copolymers and mixtures thereof, latent-crimping fibers wherein crimping is achieved upon heating, or a mixture thereof, and the above-mentioned fibers are integrated through entanglement.

[0019]

For the mesh-like web used as a mesh sheet, a sheet-like material having a mesh-like structure made of a fiber web achieved by high-speed liquid flow or air flow, and having a mesh-like pattern achieved as a result of mutual entanglement of the structural fibers, or a fiber sheet produced by punching holes in a sheet-like material where the structural fibers are entangled and integrated to form a specific pore diameter, pore pitch, and pore pattern, or a mesh sheet produced by a different method where the structural fibers are integrated as a result of entanglement and having a specific pore diameter, pore pitch, and pore pattern, can be mentioned.

[0020]

In the case when net 11 is used as a mesh sheet, it is necessary to determine the line diameter, line distance, pore diameter, pore pitch, pore pattern, etc. of the mesh taking factors into consideration such as shrinkage force, shape of the pattern based on the shrinkage factor, degree of shrinkage, and partial entanglement of the nonwoven fabric-like fiber aggregate. In specific terms, the line diameter is preferably in a range of 20-500 μm, and especially, in the range of 100-200 μm, and the line distance is preferably in the range of 2-30 mm, and especially, in the range of 4-20 mm.

[0021]

Furthermore, when mesh-like web 13 or film 14 is used as the mesh sheet, the pore diameter is preferably in the range of 4-40 mm, preferably, 8-20 mm, and the space between pores is preferably in the range of 2-20 mm, and especially in the range of 4-10 mm. Furthermore, when a material other than the above-mentioned materials is used for the mesh sheet, selection of pore diameter, etc. can be done according to the above-mentioned mesh sheet.

[0022]

As for the fiber aggregate 12 used, thermoplastic fibers such as polyesters, polyamides, polyolefins, and composite fibers thereof, split fibers or super-fine fibers produced by means of the melt-blow method, semi-synthetic fibers such as acetate, recycled fibers such as cupra and rayon, or natural fibers such as cotton can be used, and blends thereof can be used as well. The

base weight, fiber size, fiber length, cross-section shape, degree of entanglement, and strength of the nonwoven fabric-like fiber aggregate can be determined according to the intended use taking factors such as processability and cost into consideration.

[0023]

Especially, when used as a cleaning sheet, optional materials such as surfactants and oils that improve the surface properties of the sheet and efficiency of dust adsorption, or oily components that impart luster to the surface to be cleaned can be applied to the above-mentioned nonwoven fabric-like fiber aggregate. A desirable manufacturing method for the bulky sheet of concern in the present invention is explained below.

[0024]

As shown in Figures 1 and 2, fiber web 12 is laminated onto one surface or both surfaces of a mesh sheet 11 (13, 14), which undergoes shrinkage in a uniaxial or biaxial direction; subsequently, a water-jet is applied so as to entangle the fibers of fiber web 12 on one side of the mesh sheet 11 (13, 14) and the fibers of fiber web 12 on the other side, and the fibers of fiber web 12 and mesh sheet 11 (13, 14) and to form an integral structure, and at the same time, each fiber web 12 is formed into a nonwoven fabric-like fiber aggregate based on entanglement. Then, heat-shrinking is carried out for the fiber aggregate produced at the time of drying or a process separate from the drying process is applied, and heat-shrinking is carried out for the heat-shrinkable mesh sheet 11 (13, 14) so as to impart a wave-shaped pattern to the structural fiber of the above-mentioned nonwoven fabric-like fiber aggregate and to impart an overall pattern.

[0025]

In other words, as shown in Figure 5, fiber web 12 is continuously supplied from each of the carding machines 21A and 21B that form fiber web 12 via feed rolls 22. Meanwhile, roll 23 of net 11 is arranged between carding machines 21A and 21B, and mesh sheet 11(13, 14) is fed via feed roll 25 from roll 23.

[0026]

Furthermore, fiber web 12 is applied to both surfaces of mesh sheet 11(13, 14) by the above-mentioned feed rolls 22, and conveyed to water needling device 26. Furthermore, entanglement is performed for the fibers of fiber web 12 and the mesh sheet by means of water jets, and the fiber aggregates 12 located on both sides of mesh sheet 11(13, 14) with the mesh sheet are entangled so as to produce the sheet shown in Figure 2.

[0027]

After entanglement, fiber aggregate 12 and net 11 are passed through nip rolls 27 and conveyed to heating unit 28 for drying and heat-shrinkage and a heat-treatment is performed. As a result of the above-mentioned heat-treatment, mesh sheet 11(13, 14) undergoes heat-shrinkage, and as shown in Figure 4, peaks 12A and valleys 12B are formed on the nonwoven fabric-like fiber aggregate 12 entangled with mesh sheet 11(13, 14). In the heat-treatment process based on heating unit 28, a treatment is performed for the nonwoven fabric-like fiber aggregate 12 integrated with the heat-shrinkable mesh sheet 11(13, 14) at an appropriate temperature for an appropriate time. The conditions used in this case vary depending on the heat-shrinkable mesh sheet 11(13, 14), and the conditions are not especially limited as long as a shrinkage factor sufficient to impart the pattern is achieved. However, in the case of a continuously bonded sheet, the difference in the speed at the entrance side and the exit side of the heat-treatment area becomes an important consideration when shrinking occurs in the sheet flow direction. In other words, when the tensile strength is greater than shrinkage stress, it is desirable to match the speed ratio before and after with the value close to the shrinkage factor required. In the case of a continuous sheet, it can be received on a roll or subsequently cut to form the required length, folded as needed, and packaged.

[0028]

After the heat-treatment, the web is taken-up by winder 30 via nip rolls 29. It should be noted that the degree of freedom is greater in a nonwoven fabric-like fiber aggregate formed as a result of entanglement of fibers than for a nonwoven fabric produced by fusing or bonding the fibers, and in the case of the sheet of the present invention, the degree of freedom of the fiber of the nonwoven fabric-like fiber aggregate formed as a result of entanglement with the fiber web is high, and as a result of shrinkage of the heat-shrinkable mesh sheet, the degree of freedom of the structural fibers of the nonwoven fabric-like fiber aggregate is further increased.

[0029]

Therefore, the degree of entanglement of the fiber has a significant effect on the flexibility of the sheet after shrinking the heat-shrinkable mesh sheet, degree of freedom of the structural fiber, shape of the pattern, etc. When the degree of entanglement is not adequate, the entanglement can become undone at the time of shrinkage of the heat-shrinkable mesh sheet and it is not possible to impart the wave-form pattern to the nonwoven fabric-like fiber aggregate. In the following, the bulky sheet of the present invention is explained further in specific terms with application examples.

[0030]

Application Example 1

A fiber web with a base weight of 8 g/m^2 was formed with a polyester fiber having a size of 1.5 denier by 51 mm and standard carding, lapping (not shown in the figure) of the fiber web produced was carried out to form 5 layers (40 g/m^2), the above-mentioned fiber web was laminated to form upper and lower layers using a polypropylene net (line distance 9 mm, line diameter 0.2 mm) as a mesh sheet that shrinks in biaxial directions as the interlayer, and then, entanglement was performed by means of water needling. In this case, the water pressure used for the water needling was 40 kg/cm^2, nozzle pitch was 1.6 mm, and speed was 5 m/min. Subsequently, a heat-treatment was applied for 50 sec with hot air at 130°C, shrinking of the net occurred at the time of drying, and a bulky sheet with a pattern having a shrinkage factor of approximately 10% in the vertical direction as well as horizontal direction was produced.

[0031]

In this case, the shrinkage factor is obtained from the formula below.

Shrinkage factor = ((X-Y)/X) x 100%

In the formula above, X is the length of one side before heat shrinkage, and Y is the length of the side after heat shrinkage.

Application Example 2

A fiber web with a base weight of 8 g/m^2 was formed from a rayon fiber with a size of 1.5 denier by 51 mm using standard carding, lapping (not shown in the figure) was carried out for the fiber web produced to form 10 layers (80 g/m^2), and lamination was carried out for a biaxially-shrinkable polypropylene net (line distance 9 mm, line diameter 0.2 mm) used as the lower layer of the mesh sheet, and the above-mentioned fiber web as the upper layer; then, entanglement was done by means of water needling. In this case, the water pressure of the water needling used was 40 kg/cm^2, nozzle pitch was 1.6 mm, and speed was 5 m/min. Subsequently, a heat-treatment was applied for 60 sec with hot air at 130°C, shrinkage of the net was achieved, and a bulky sheet with a pattern having a shrinkage factor of approximately 10% in the vertical direction as well as in the horizontal direction was produced.

[0032]

<u>Comparative Example 1</u>

A fiber web with a base weight of 10 g/m^2 was formed from a polyester fiber with a size of 1.5 denier by 51 mm using standard carding, lapping (not shown in the figure) was carried out for the fiber web produced to form 10 layers (100 g/m^2), and entanglement was achieved by means of water needling. In this case, the water pressure of the water needling was 40 kg/cm^2, nozzle pitch was 1.6 mm, and speed was 5 m/min.

[0033]

Conditions used for Application Examples 1 and 2 and the comparative example are summarized and shown in Table 1.

[0034]

Table 1

		1 厚み (mm)	2 坪量 (g/m^2)	3 密度 (g/cm^3)	4 柔軟性 (mm) (CD-MD)
5 実施例	1	2. 5	100	0. 040	51−51
	2	2. 5	100	0. 040	47−48
6 比較例		1. 0	100	0. 100	56−100

Key:
1 Thickness
2 Basis
3 Density
4 Flexibility
5 Application example
6 Comparative example

The thickness is the mean thickness of one piece obtained upon stacking [and measuring] 10 pieces of nonwoven fabric. The density was calculated from the thickness and base weight according to the formula shown below.

[0035]

Density = base weight/(thickness x 1000)

A measurement of the flexibility was done according to the cantilever method (JIS L-1085, 5.7A). In this case, MD in Table 1 is the flow direction, and CD is the crossflow direction. Among the above-mentioned application examples and comparative example, a comparison test for effect was carried out for Application Example 1 and the comparative

example. In this test, each sheet produced in Application Example 1 and the comparative example was used as a cleaning sheet and the collection of various dust, namely, cotton dust, bread crumbs, and loose hair was evaluated. The results obtained are shown in Table 2.

[0036]

Table 2

	1 熱収縮率 (%)		2 ダストの種類と捕集性		
	3 縦	4 横	綿ぼこり 5	パンくず 6	毛髪 7
8 実施例1	10	10	◎	○	○
9 比較例1	0	0	○	×~△	△

Key:
1 Heat-shrinkage factor
2 Type of dust and collection efficiency
3 Vertical direction
4 Horizontal direction
5 Cotton dust
6 Bread crumbs
7 Loose hair
8 Application Example 1
9 Comparative Example 1

Evaluation of dust collection efficiency
◎: Excellent collection without any problems
O: Good collection without any problems
Δ: Adequate collection efficiency
X: Poor collection efficiency

As shown in Table 2, when the bulky sheet of concern in the present invention is used as a cleaning sheet, a higher collection efficiency can be achieved in all cases, for cotton dust, bread crumbs, and loose hair, and not only fine dust such as cotton dust but also relatively large dust such as bread crumbs can be trapped; furthermore, a relatively long-fibered dust such as loose hair can be trapped as well, and successful cleaning of a wide variety of dust that has not been possible with conventional cleaning sheets can be achieved.

[0037]

Furthermore, when compared with conventional cleaning sheets where adsorption of dust depends on oily agents, the proportion of the oily agent used can be reduced with the cleansing sheet of the present invention. As a result, decomposition or discoloration of the surface being cleaned as a result of transfer of the oily agent to the cleaning surface can be prevented, and transfer of the oily agent to the hands also can be controlled to a minimum.

Application Example 3

A fiber web with a base weight of 10 g/m^2 was formed from a polyester fiber with a size of 1.5 denier by 51 mm using a standard carding, and lapping (not shown in the figure) was carried out for the fiber web produced to form 3 layers (30 g/m^2), and lamination was carried out for a mesh sheet made of a polypropylene/modified polypropylene fiber aggregate having a metsuke of 20 g/m^2 having circular pores with a diameter of 30 mm and a pore separation of 10 mm as the upper layer, and then, entanglement was performed by means of water needling. In this case, the water pressure of water needling used was 40 kg/cm^2, nozzle pitch was 1.6 mm, and speed was 5 m/min. Subsequently, a heat-treatment was performed for 50 sec with a hot air of 130°C and shrinking of the net was achieved at the same time, and a bulky sheet with a pattern having a shrinkage factor of approximately 10% in the vertical direction as well as in the horizontal direction was produced.

[0038]

Comparative Example 2

A fiber web with a base weight of 10 g/m^2 was formed with a polyester fiber with a size of 1.5 denier by 51 mm using a standard carding, and lapping (not shown in the figure) was carried out for the fiber web produced to form 8 layers (80 g/m^2), and entanglement was achieved by means of water needling. In this case, the water pressure of water needling was 40 kg/cm^2, nozzle pitch was 1.6 mm, and speed was 5 m/min.

[0039]

Conditions used in Application Example 3 above and Comparative Example 2 are summarized and shown in Table 3.

[0040]

Table 3

	1 厚み (mm)	2 坪量 (g/m^2)	3 密度 (g/cm^3)	4 柔軟性 (mm) (CD-MD)
5 実施例3	10.0	78	0.0078	30−30
6 比較例2	0.8	80	0.1	50−70

Key:
1 Thickness
2 Base weight
3 Density
4 Flexibility
5 Application Example 3
6 Comparative Example 2

Application Example 4

A fiber web with a base weight of 8 g/m^2 was formed from a polyester fiber with a size of 1.5 denier by 51 mm using a standard carding, and lapping (not shown in the figure) was carried out for the fiber web produced to form 5 layers (40 g/m^2), and lamination was performed with an interlayer made of a biaxially-shrinkable porous polypropylene film (bore diameter of 10 mm, space between pores of 3 mm and thickness of 15 μm) used as a mesh sheet and the fiber web on the upper and the lower layers; then, entanglement was achieved by means of water needling. In this case, the water pressure of water needling used was 40 kg/cm^2, nozzle pitch was 1.6 mm, and speed was 5 m/min. Subsequently, a heat-treatment was carried out for 50 sec with hot air at 130°C and shrinking of the net was achieved at the same time, and a bulky sheet with a pattern having a shrinkage factor of approximately 10% in the vertical direction as well as in the horizontal direction was produced.

[0041]

Conditions used for the application example above are shown in Table 4.

[0042]

Table 4

	1 厚み (mm)	2 坪量 (g/m²)	3 密度 (g/cm³)	4 柔軟性 (mm) (CD-MD)
5 実施例4	2. 6	100	0. 038	50－50

Key: 1 Thickness
2 Base weight
3 Density
4 Flexibility
5 Application Example 4

As shown in Table 3 and Table 4 above, according to Application Examples 3 and 4 above, bulky sheets having superior fiber density and flexibility compared to those of the above-mentioned Comparative Example 2 and having excellent softness and texture can be produced.

[0043]

Effect of the invention

The bulky sheet of the present invention has the necessary strength and good flexibility and texture. Furthermore, according to the manufacturing method of the bulky sheet of the present invention, the above-mentioned bulky sheet can be produced efficiently. Furthermore, the nonwoven fabric-like fiber aggregate that comprises the sheet itself exhibits uniform bulkiness and the bulky sheet of the present invention has overall uniformity; thus, a significant increase in the degree of freedom can be achieved, and practical strength can be imparted to a nonwoven fabric-like fiber aggregate with a lower degree of entanglement by means of the mesh sheet.

[0044]

Furthermore, when used as a cleaning sheet, a flexible wave-form pattern is imparted to the surface of the bulky sheet, thus, entrapment of dust that comes in contact with the sheet can be easily done. Furthermore, in comparison to conventional shrinkable sheet-like materials, the peaks and valleys of the wave-form pattern formed are smaller since entanglement of the nonwoven fabric-like fiber aggregate extends through the entire area, but the wave-form pattern can be increased when a mesh sheet is used for the shrinkable sheet in the present invention and the degree of bulkiness can be increased and the surface appearance can be further increased.

<u>Brief description of the figures</u>

Figure 1, cross section that shows the stacked state of mesh sheet and nonwoven fabric on one side of the bulky sheet of Application Example 1 observed early in the production process.

Figure 2, a cross section of the bulky sheet of a different application example of the present invention.

Figure 3, a cross section of the finished product for the bulky sheet shown in Figure 1.

Figure 4, a cross section of the finished product of the bulky sheet shown in Figure 2.

Figure 5, an overall diagram of the production machine used for production of the bulky sheet shown in Figure 4.

Figure 6, top view of the net used as the mesh sheet.

Figure 7, top view of fiber aggregate used as the mesh sheet.

Figure 8, top view of porous film used as the mesh sheet.

Explanation of symbols

10	Bulky sheet
11, 13, 14	Mesh sheet
12	Fiber web or fiber aggregate
12A	Peak region
12B	Valley region

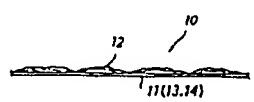


Figure 1

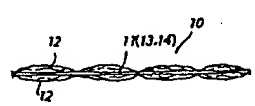


Figure 2

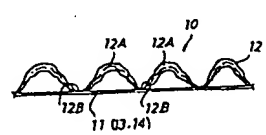
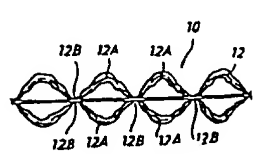


Figure 3



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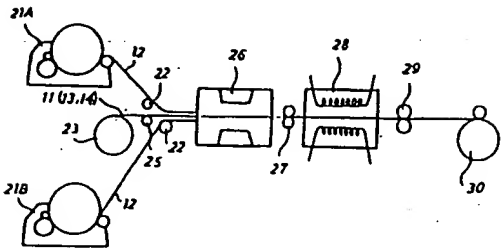

Figure 5

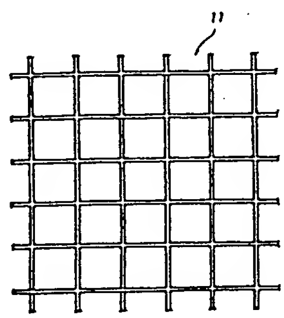

Figure 6

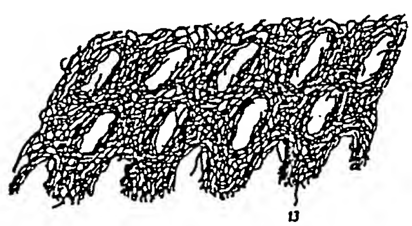

Figure 7

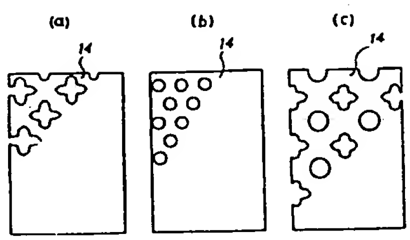

Figure 8